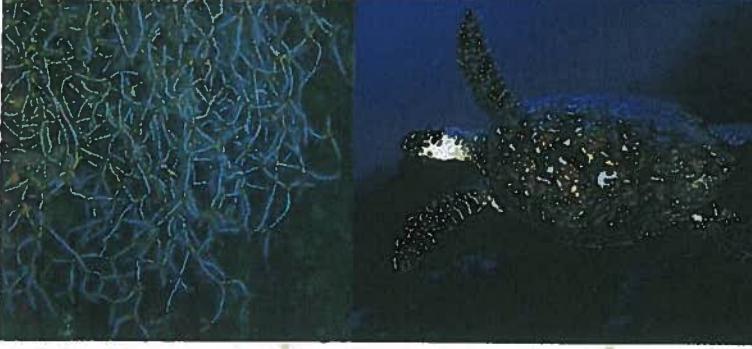
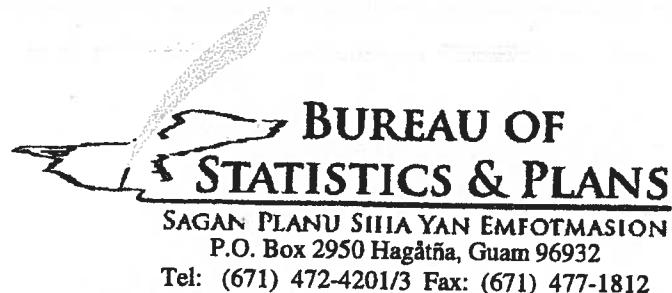


Guam Coral Reef Local Action Strategies



Eddie Baza Calvo
Governor of Guam

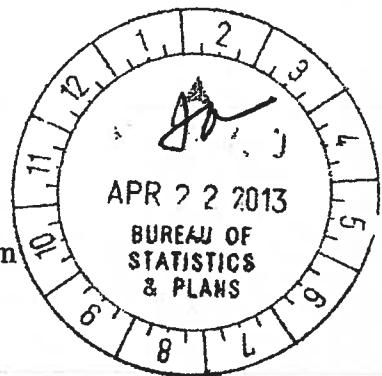
Ray Tenorio
Lieutenant Governor



Lorilee T. Crisostomo
Director

MEMORANDUM (INTER-OFFICE)

TO: Director, Bureau of Statistics and Plans
FROM: Administrator, Guam Coastal Management Program
SUBJECT: Guam's Coral Reef Local Action Strategies



The Coral Reef Local Action Strategies for Guam, as requested in your email dated on April 18, 2013, are attached. Please feel free to contact me if you have any questions or comments.



EVANGELINE D. LUJAN

Attachment:
Guam's Coral Reef Local Action Strategies

Guam's Coral Reef Local Action Strategies



Guam's coral reefs are the essence of the economic, cultural, political and social viability of the island. There are approximately 5000 species of marine organisms recorded in Guam. Guam's coral reefs are under stress and being degraded from natural anthropogenic causes. In 1997, the Government of Guam established the Coral Reef Initiative (CRI) to address threats to the reefs. The Bureau of Statistics and Plans, Guam Coastal Management Program, Department of Agriculture, Division of Aquatic and Wildlife Resources, and Guam Environmental Protection Agency lead most of the efforts of the CRI.

- **Land Based Sources of Pollution**
- **Fishery Management**
- **Recreational Use and Misuse**
- **Climate Change and Reef Resilience**
- **Department of Defense (DoD) Expansion and Related Impacts**



Guam Coral Reef Local Action Strategies Land-Based Sources of Pollution



Background and Rationale

In August 2002, the Guam Coral Reef Initiative Coordinating Committee (GCRICC) began to identify the main threats to local coral reefs as part of a process to prioritize funding and management efforts for the next three years. By February 2003, GCRICC identified local navigators and drafted Local Action Strategies (LAS) for four of the five chosen focus areas. The LAS process significantly expanded and enhanced the network of stakeholder groups working on coral reef issues.

Goals and Objectives of the Current LAS

Guam's Land-Based Sources of Pollution LAS working group outlined three main goals: 1) Reduce sediment in three of Guam's watersheds; 2) Manage the impacts of non-point source pollution through Guam Nonpoint Pollution Control Program; and 3) Govern activities directly impacting waters through federally authorized Water Quality Certification Program. These were further refined in the Guam Coral Reef Management Priorities document for 2010-2015, which shows how Guam's priority goals and objectives correlate to the NOAA Coral Reef Conservation Program (CRCP) National Goals and Objectives for coral reef conservation including guiding funding allocations for management activities.

Goal: Improve the condition of coral reef ecosystems by reducing the amount of sediment and pollution from development, fires, recreational users and agriculture in Guam's watersheds.

Objectives:

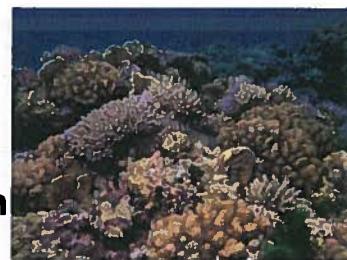
1. Implement Conservation Action Plans (CAPs) for priority watersheds by 2015 as a model approach to site-based planning and management. (The Piti CAP includes activities to manage land-based sources of pollution and recreational impacts to reefs, increase awareness of the impacts to reefs and fill gaps in knowledge through management-related research.)
2. Encourage implementation of revised Guam Soil Erosion and Sediment Control and Stormwater Rules and Regulations, Guam Seashore Reserve Plan, and updated zoning and building codes pending formal approval.
3. Educate target stakeholder groups about sedimentation issues associated with specific watershed uses and activities.

Proactive, practical and targeted management is urgently needed. The following actions were implemented to address the objectives listed in Guam's Coral Reef Priority Document:

- a) Implement Conservation Action Plans (CAPs) for priority watersheds (Piti/Asan, Manell/Geus);
- b) Develop site planning of best management practices for erosion prevention;
- c) Promote conservation programs on private agriculture lands to address sustainable land management practices and habitat management;



Guam Coral Reef Local Action Strategies Land-Based Sources of Pollution



- d) Support strengthening of Guam's non-government organizations to build technical capacity for watershed work;
- e) Demonstrate use of innovative low cost erosion and surface water best management practices;
- f) Develop action plan to address highly trafficked access and walking trails for recreation and conservation activities to reduce erosion;
- g) Support community awareness to address GovGuam updates to existing rules and regulations regarding conservation areas, overall update and strengthening of existing legislation.

Assessed gaps in LAS & recommendations for the next LAS

Partnerships need to be better identified and the roles and responsibilities of the partners must be clearly defined to continue to move forward with Guam's goals. With clearly defined relationships and responsibilities, efforts to address the most common sources of LBSP such as stormwater, waste water and sediment from erosion and runoff from construction, urban/commercial areas, wild-lands recreation/off-roading and grasslands arson will be more effective.

In addition to defining relationship roles, a review of land-based recreational activities that may contribute to LBSP would be beneficial (i.e. Improving walking trails and access points may also reduce erosion in areas that are highly trafficked).

1. Memorandums of Understanding (MOUs) will help keep projects and efforts on track as leadership changes within the Government of Guam.
2. Identifying target audiences for public service announcements for a variety of recreational issues i. e. illegal driving on beaches.
3. Study of recreational activities. Provide information for assessing best management practice guidelines for land-based recreational activities.

Table 1. Five-year Local Action Strategy Planning Document, 2010-2015**Focus Area:** Land-Based Sources of Pollution**Goal:** Improve the condition of coral reef ecosystems by reducing the amount of sediment and pollution from development, fires, recreational users and agriculture in Guam's watersheds.

Grant Title	Description	PI	Agency	Amount	Match	Status
CRI04 LAS implementation	Outreach campaign for watershed conservation		Ag - Forestry	26500	26500	
CRI05 Development of a GIS based erosion potential model for estimating sediment delivery to estuarine and coral reef environments of southern Guam	GIS based erosion potential model for a southern Guam watershed; examine relationship between actual sediment production and hydrologic factors such as stream flow, rainfall.	Shahram Khosrowpanah	UOG	35886	8929	WERI
CRI05 Arson campaign coordination	Contract arson campaign coordinator to develop/implement community based education program. Work with mayors, conduct workshops, create new outreach materials.	Joseph Mafnas	DAWR	32000		Completed. Position filled.
CRI05 Guam urban forestry demonstration project	Educate community on effects of urban stormwater runoff on adjacent coral reefs; involve them in potential solution. Focus on northern watershed with 5 demonstration plots in commercial areas.	David Lunitaco (Joseph Mafnas)	Forestry	24500	132074	Completed and ongoing by Arson Campaign Coordinator - Urban Forester Hire.
CRI05 Fouha Bay / Forest resource management	Reforest watershed draining into Fouha Bay. First phase, 50 acres, complete in 2003. Additional 35,000 acacia seedlings to be planted on 30-35 acres.	David Lunitaco (Joseph Mafnas)	Forestry	25500	25100	Completed. Additional work under other funding.
CRI06 Studying the effects of tree planting and erosion control measures in Fouha Watershed	Multi year, multi agency effort to restore Fouha. Forestry Steward component + private landowner participation.	David Lunitaco (Joseph Mafnas)	DOA FSR	21000		Completed.
CRI06 Developing a digital watershed atlas for Guam	Web based GIS tool for southern watersheds	Shahram Khosrowpanah	UOG WERI	99000	33099	Completed: www.Hydroguam.net
CRI06 Watershed restoration workshop (phase I) and staff development in erosion control measures and reducing sedimentation in Guam's coastal waters (Phase II)	Host watershed recreation workshop for DPW, GEPA, DOAg, GCA, GCMP, etc.	Evangeline Lujan	GCMP	20000	15000	Completed. Document available at GCMP: Sedimentation and Erosion Control Field Guide
CRI06 Watershed restoration/ erosion control phase II – send staff to training	Send DPW staff to training to help reduce erosion	Evangeline Lujan	GCMP	15000		
CRI07 Pitt Asan Watershed restoration and management enhancement	Assessment study and develop plan	Evangeline Lujan	GCMP	258051		Ongoing. Pitt/Asan Management Plan Completed, copy available at GCMP.

Table 1. Five-year Local Action Strategy Planning Document, 2010-2015**Focus Area: Land-Based Sources of Pollution**

Goal: Improve the condition of coral reef ecosystems by reducing the amount of sediment and pollution from development, fires, recreational users and agriculture in Guam's watersheds.

Grant Title	Description	PI	Agency	Amount	Match	Status
CRI07	Evidence of soft corals as bioindicators of persistent contaminants in Guam's coastal waters, phase II	Peter Schupp and Gary Denton	UOG ML/WERI	36949	10725	Completed.
CRI08 Watershed model	Development of cheap and reliable alternative to semipermeable membrane devices for water quality studies	Evangeline Lujan	GCMP	10000		Completed. Just needs to be displayed at designated location.
CRI08 [Piti/Asan watershed restoration and management database]	Interactive 3D model of Guam watershed	Evangeline Lujan	GCMP	76500		Completed.
CRI08 Masso watershed restoration	Infrastructure improvements - Santos Memorial Park	Evangeline Lujan	GCMP	50000		Ongoing.
CRI08 Piti Asan restoration phase II	Planting project - acacia, native underplanting - 50 acres of Masso Reservoir area (see previous entry)	Evangeline Lujan	GCMP	8500		Completed.
CRI08 LAS Workshop	Update fisheries and LBSP LAS	Evangeline Lujan	GCMP	11500		Completed.
LBSP - Manell/Geus watershed - preliminary comprehensive watershed management plan	Watershed management plan for Manell Geus (CAP and survey work)	Evangeline Lujan	GCMP	13000		Ongoing.
CRI10 LBSP - Asan/Piti watershed enforcement officers for arson + MPA violations	Funding for 2 conservation officers with a focus on arson and poaching events in the watershed.	Mike Reyes	Dept of Ag	66735		Completed. Two officers hired.
CRI10 Asan/Piti - Streambank stabilization using natural fibers	Vegetative stabilization methods for 200 feet of Masso bank close to the river outlet.	Jesse Cruz	GEPA	110500		Completed.
CRI10 Asan/Piti - Determine threshold level for sediment	Threshold levels of sediments above which coral larvae and new recruits suffer >50% mortality; measure effect of sedimentation rates on coral survival and recruitment in Asan/Piti watershed.	Peter Schupp (Tom Schilis)	UOG	48995	23050	Just completed, waiting on final report.
CRI11 Piti Asan CAP - develop erosion potential GIS model to determine appropriate areas for reforestation	Data collection; GIS assessment to support Piti/Asan CAP; creation of GIS model to determine critical areas within the watersheds in need of preservation or restoration; management recommendations.	Shahram Khosrowpanah	UOG	60000		Completed.

Table 1. Five-year Local Action Strategy Planning Document, 2010-2015**Focus Area:** Land-Based Sources of Pollution

Goal: Improve the condition of coral reef ecosystems by reducing the amount of sediment and pollution from development, fires, recreational users and agriculture in Guam's watersheds.

Grant Title	Description	PI	Agency	Amount	Match	Status
CRI11 Community based stewardship projects in Piti/Asan	Watershed education program for residents in priority watershed. Stakeholder meetings, individual household visits, BMP implementation at residential level for interested residents.	Bob Barber	UOG	20000		Ongoing.
CRI11 Determining threshold levels for sediment Year 2	Year 2, see CRI GU10	Peter Schupp (Tom. Sibils)	UOG	44082	14625	Completed.
CRI11 Educational campaign - RARE and Guardians of the Reef	Maintain Guam Southern watershed campaign; community efforts such as tree plantings, soil stabilization, and cleanups. Guardian support and focus on fires/arson as watershed (and coral) threats.	Elaina Todd (Christine I. Camacho)	GCMP	60000		Ongoing
CRI12 Watershed coordinator and support for Piti CAP	Cost shared position with funds for NGO involvement and supplies to implement reforestation projects and other actions from Piti CAP.	Evangeline Lujan	GCMP	70000		Ongoing.
CRI12 Erosion and sediment control workshop	Workshop and certification course for contractors, developers to learn BMPs for ESC.	Evangeline Lujan	GCMP	35000		Completed.
CRI12 Implementing field assessments	Hire Inspector to monitor construction projects, conduct assessments to improve enforcement of ESC regulations.	Jesse Cruz	GEPA	50000		Status verification necessary.
CRI12 Enforcement officer for arson and MPA violations	Hiring 3 Conservation Officers.	Jay Gutierrez	DAWR	88640		Ongoing. One officer in place and two positions to fill.
CRI13 Watershed coordinator supporting Piti CAP	Hiring a Piti/Asan Program Coordinator	Evangeline Lujan	GCMP	30000		Ongoing.
CRI13 Support for Piti and Manell watershed	Support for Piti Conservation Action Plan - removing invasive species. Support for Manell watershed in streambank stabilization, invasive species removal and other restoration efforts.	Evangeline Lujan	GCMP	90000		Ongoing.
CRI13 Enforcement officer for arson and MPA violations	Year 2	Jay Gutierrez	DAWR	44000		See above. Ongoing. One officer in place and two positions to fill.

Table 1. Five-year Local Action Strategy Planning Document, 2010-2015**Focus Area:** Land-Based Sources of Pollution**Goal:** Improve the condition of coral reef ecosystems by reducing the amount of sediment and pollution from development, fires, recreational users and agriculture in Guam's watersheds.

Grant	Title	Description	PI	Agency	Amount	Match	Status
CRI15	Manell restoration	Phase II - use WERI results to identify critical areas for reforestation, streambank stabilization or other restoration efforts as appropriate.	Evangeline Lujan	GCMF	\$1000		Ongoing.

* PI's as originally written into the Grants.



Guam Coral Reef Local Action Strategies Guam Fisheries Management



Background and Rationale

In August 2002, the Guam Coral Reef Initiative Coordinating Committee (GCRICC) began to identify the main threats to local coral reefs to prioritize funding and management efforts for the next three years. By February 2003, GCRICC identified local navigators and drafted Local Action Strategies (LAS) for four of the five chosen focus areas. The LAS process significantly expanded and enhanced the network of stakeholder groups working on coral reef issues.

Guam's fishery resources provide valuable ecological, economic, and cultural benefits to Guam. Not only do fish provide valuable food for island residents, but fish are an integral component of Guam's complex reef ecosystems and are necessary for healthy reefs. After major declines in Guam's reef associated fisheries in the late 1980s – early 1990s, the Guam Legislature created the five Guam Marine Preserves. The overall goal of this LAS is to support sustainable management of Guam's reef fish to facilitate healthy fisheries and resilient coral reefs that can benefit current and future generations.

Goals and Objectives of the Current LAS

The initial LAS focused on enhancing the management of the Marine Preserves to maximize their impact on fish stocks. The 2005 LAS revision began looking at management issues outside of the preserves. These goals and objectives were further refined in the Guam Coral Reef Management Priorities document for 2010-2015 which shows how Guam's priority goals and objectives correlate to the NOAA Coral Reef Conservation Program (CRCRP) National Goals and Objectives for coral reef conservation including guiding funding allocations for management activities. The 2010 Priorities Document has the most recent and comprehensive goals and objectives for this LAS.

GOAL 2: Protect Guam's coral reef fisheries resources for current and future generations through effective management that conserves aquatic and marine ecosystems and ensures the condition, welfare and integrity of marine ecosystems.

Objectives:

1. Increase management-related monitoring and research of coral reef fisheries to determine the status of target reef fishery stocks, levels of effort that are sustainable, habitat impacts and management effectiveness.
2. Create community management programs that increase public knowledge of, support for, and participation in marine preserves and science-based management.
3. Increase socioeconomic monitoring and research to better understand the interactions of users with the resources.
4. Support, enhance and improve the regulations of resource use activities that impair fisheries or fish habitat.
5. Improve educational programs to enhance understanding of fisheries status and management needs.
6. Develop partnerships with federal resource managers to facilitate effective management of aquatic resources in federally controlled areas (e.g., National Park Service, DoD).
7. Develop management strategies to address indigenous fishing rights as per Public Law 29-127.

The following projects have been conducted or are ongoing:



Guam Coral Reef Local Action Strategies Guam Fisheries Management



- a. The Long Term Comprehensive Coral Reef Monitoring Program was established and continues to monitor fish, benthic habitat, and macroinvertebrates. Current sites include Tumon Bay, East Agana, Piti Bay, and Western Shoals. Additional data has been collected by the NOAA Coral Reef Ecosystem Division at sites around the island.
- b. Researchers at the Marine Lab completed tagging / tracking projects for mafute (*Lethrinus harak*), tataga (*Naso unicornis*), and hangon (*Naso lituratus*). In addition, researchers collected key life history and recruitment data on these and other species.
- c. Work is continuing on current models and connectivity through both ocean current modeling and genetic analysis. Efforts are supported by NPS, USGS, UOGML, NOAA and others.
- d. The Limits of Acceptable Change process engaged community members in managing non-fishing activities within the Piti and Tumon Marine Preserves.
- e. The Guam Community Coral Reef Monitoring Program is working with community members to monitor Guam's reef flats.
- f. The Coral Reef funding has improved enforcement effectiveness by providing vehicles, gear, supplies and maintenance for an enforcement vessel, and funding for additional staff.
- g. The Marine Lab has also completed projects on spawning aggregations sites, the role of soft corals as fish habitat, the population biology of parrotfish, and is currently examining sustainable catch limits for sea cucumbers.
- h. NOAA PIFSC and PIRO have conducted socioeconomic surveys / interviews in recent years. Results are expected in 2013.

Assessed gaps and recommendations for next LAS

This LAS as described in the 2010 Priorities Document remains highly relevant. However, there is a need to support key activities and programs to improve fisheries management.

Support for enforcement activities is one of the biggest priorities. There are limited funding sources available for enforcement and current local expenditures for conservation enforcement are insufficient.

The Conservation Officer Reserve Program and the Marine Preserve Eco-Permits, need to be implemented. Monitoring programs should continue to receive support as they provide valuable information on the status of fish communities and habitat. Plans to include additional information on water quality should move forward. Socioeconomic monitoring needs to be improved.

Current life history and spawning aggregation data is limited. Life history data collection programs should expand and more effort should be expended to identify and manage spawning areas. These data are necessary to expand management beyond current approaches. Support for current modeling and connectivity studies should be increased to facilitate long term planning and management of coral reef resources.

The Community Coral Reef Monitoring Program has limited funding through 2014, but may need to identify another funding source after that time to continue. Additional community programs should be supported.

Table 1. Five-year Local Action Strategy Document, 2010-2015**Focus Area: LAS Guam Fisheries Management**

Goal: Protect Guam's coral reef fisheries resources for current and future generations through effective management that conserves aquatic and marine ecosystems and ensures the condition, welfare and integrity of marine ecosystems.

Grant Title	Description	PI	Agency	Amount	Status
CRI04 Natural resources prosecutor	Dedicated attorney for resources and prosecution.			100000	Completed.
CRI04 Larval tracking study	Determine whether preserves are seeding outside areas to augment fish stocks outside protected sites.	Mark Tupper	UOG	50000	Incomplete. Limited information on results - Preliminary report to DAWR, status reports, no final document.
CRI04 Law enforcement vehicles	Augment enforcement by providing 3 vehicles to Conservation Officers.	Trina Leberer	DAWR	90000	Completed. 4 Nissan Frontiers obtained.
CRI05 Assessment of algal abundance, composition and chemical defense on Guam reef flats in relation to herbivore stocks and nutrients in MPAs of Guam	Abundance and types of algae and fishes; feeding preferences of herbivorous fish, supplies and flux of nutrients in 3 MPAs and control sites. Are algae communities results of "top down" (grazing) or "bottom up" (nutrient) processes?	Peter Schupp	UOG	81260	Incomplete. Graduate student N. Pioppi did not complete thesis
CRI05 Role of soft corals as reef fish habitat in an MPA	Characterize soft coral as habitat for juvenile/adult fish in Piti Bomb Holes.	Terry Donaldson	UOG	47000	Completed. Resulted in UOGML Thesis - N. Meyer
CRI05 Development and implementation of a DAWR conservation officer reserve program	Volunteer CO program, equipment and support to improve enforcement	Trina Leberer	DAWR	45000	Completed with Modifications. Gear for reserve officers obtained. Lack of regulations for program prevented hiring of officers.
CRI06 Assessment of Algal Abundance on Guam Reef Flats in relation to herbivore stocks and nutrient levels in marine protected areas of Guam	Abundance and type of algae, feeding preferences of herbivorous fishes, supplies and flux of nutrients in 3 MPAs and control sites (continuation of previous year study).	Peter Schupp	UOG ML	67228	Incomplete. Graduate student N. Pioppi did not complete thesis
CRI06 Improve enforcement of Guam's coral reef reserves	Volunteer CO program, equipment and support to improve enforcement	Jay Gutierrez and Mike Reyes	DoAg, DAWR + Cos	45000	Completed with Modifications. Gear for reserve officers obtained. Lack of regulations for program prevented hiring of officers.
CRI06 User friendly fishing regulations	Publication of regulation guide	Jay Gutierrez and Mike Reyes	DoAg, DAWR + Cos	20000	Completed. Booklet distributed.

Table 1. Five-year Local Action Strategy Document, 2010-2015**Focus Area: LAS Guam Fisheries Management**

Goal: Protect Guam's coral reef fisheries resources for current and future generations through effective management that conserves aquatic and marine ecosystems and ensures the condition, welfare and integrity of marine ecosystems.

Grant	Title	Description	PI	Agency	Amount	Status
CRI07	Characterization of identified reef fish SPAg sites in Piti and Asan	Map spawning aggregation sites on inshore reefs of Piti and Asan; define roles of sites; make management recommendations (report + database + map series)	Terry Donaldson	UOG ML	30000	Completed. Resulted in UOGML Thesis - K. Chop
CRI08	Resident reef fish spawning aggregations in an MPA		Terry Donaldson	UOG ML	47720	Incomplete? Looking for final document.
CRI08	Eco summer camp	Partner with 4H fishery camp - fisheries/coral reef management camp	Cliff Kyota	UOG	21000	Completed. Provided support for camp.
CRI08	LAS Workshop	Update fisheries and LBSP LAS	Evangeline Lujan	GCMP	11500	Completed. Workshops held to review LAS efforts.
CRI09	Assessment of fish functional diversity inside and outside Guam's marine preserves: Is there a significant "preserve" effect?	Comprehensive measure of functional diversity of reef fish assemblages on Guam. Clear picture of preserve effects.	Jennifer McIlwain	UOG	55080	In progress
CRI09	Improving management of Guam's reef-associated fishery through an assessment of SCUBA spearfishing and its impact on fish assemblages	Analyze catch data, document impact of SCUBA spear on reef fish assemblages, compare abundance of deepwater assemblages between Guam and other sites with no SCUBA spear, policy recommendations.	Jennifer McIlwain	UOG	60080	In Progress. Draft report delivered.
CRI10	Determining sustainable catch limits for Holothurians	Comprehensive measure of species composition and diversity of commercially valuable holothuroids on Guam. Explore role of MPAs in protecting holothuroids. Populations size structure and initial management plan.	Alex Kerr	UOG	64745	In progress. Awaiting final report.

Table 1. Five-year Local Action Strategy Document, 2010-2015**Focus Area:** LAS Guam Fisheries Management

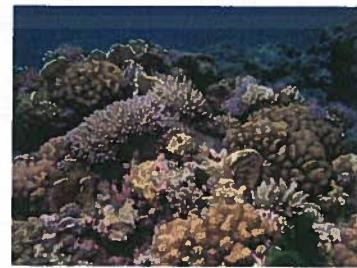
Goal: Protect Guam's coral reef fisheries resources for current and future generations through effective management that conserves aquatic and marine ecosystems and ensures the condition, welfare and integrity of marine ecosystems.

Grant	Title	Description	PI	Agency	Amount	Status
CRI11	Population biology and assessment of commercially important and functionally diverse parrotfish species from Guam and greater Micronesia	Determine sex-specific age/growth rates for at least 4 parrotfish sp. Investigate reproductive biology of 4 parrotfish species (size/age at maturation and sex change, sexual pattern and potential pathways, sex-specific repro. capacity by size and age). Age-structured per-recruit models to guide management strategy.	Jennifer McIlwain	UOG	44046	In progress
CRI11	Determining sustainable catch limits for Holothurians - year 2	See CRU GU10	Alex Kerr	UOG	56925	In progress. Awaiting final report.
CRI12	Support for culturally managed areas		Jay Gutierrez	DAWR	15000	In progress
CRI12	Enforcement officer for arson and MPA violations		Jay Gutierrez	DAWR	88640	In progress. 2 LTA officers hired.
CRI13	Improve and analyze fisheries data	Synthesize and analyze Guam fisheries data. Examine seasonal trends in catch and effort data; develop stock assessment models for target species; recommendations to improve survey data technique; develop database.	Andrew Halford	UOG	87610	In progress
CRI13	Enforcement officer for arson and MPA violations	Year 2	Jay Gutierrez	DAWR	44000	In progress

Local Action Strategy Planning Document						
Focus Area: Fisheries Management (2005-2007)						
Goal: To identify non-sustainable fishing practices, develop sustainable alternatives, and develop demand schedules to reduce overcatch.						
Project Title:	Objective:	How long will the project last? (Year 1, 2, or 3)	Who's going to do the work?	Estimated Cost:	Funded (Y/N)	Funding Source
Assess algal abundance on reef flats in relation to herbivore stocks and nutrient levels in MPAs	Conduct additional monitoring of areas inside and outside of the preserves	1, 2	University of Guam Marine Laboratory	\$150,000	year 1 funded	2005 NOAA/DOI Coral Management Grant
Evaluate the role of soft corals as reef fish habitat in MPAs	Develop a base for protecting soft coral habitats as a means of promoting increased diversity of fish inside and outside of the preserves	1	University of Guam Marine Laboratory	\$47,000	Y	2005 NOAA/DOI Coral Management Grant
Monitor seagrass beds	Study and assess size, health, productivity and seasonal changes of seagrass beds	1, 2	University of Guam Marine Laboratory	\$44,000	year 1 funded	2005 NOAA Coral Monitoring Grant; Pending 2006 NOAA Coral Monitoring Grant
Establish conservation officers reserve program	Increase assistance and enforcement of regulations in preserves	1, 2	Division of Aquatic and Wildlife Resources	\$85,000	year 1 funded	2005 NOAA/DOI Coral Management Grant
Capacity build - coral monitoring assistant	Provide capacity to support marine programs	1, 2, 3	Division of Aquatic and Wildlife Resources	\$100,000	Y	2004-2005 NOAA Coral Monitoring Grant
Capacity build - coral coordinator	Provide capacity for Coral Reef Initiative programs	1, 2, 3	Bureau of Statistics and Plans	\$180,000	?	Pending 2006 NOAA Coral Management Grant
Improve enforcement of preserves	Provide equipment and increase manpower to enforce regulations in preserves	1	Division of Aquatic and Wildlife Resources	\$45,000	?	Pending 2006 NOAA Coral Management Grant
Establishment of permanent coral reef monitoring sites for invertebrates, algae, and fish	Provide detailed data of health of Guam's reefs	1, 2, 3	Division of Aquatic Resources and Wildlife, University of Guam Marine Laboratory, Guam Environmental Protection Agency	\$115,000	?	Pending 2006 NOAA Coral Monitoring Grant
Additional monitoring of areas outside preserves	Conduct inventory and assessment of existing coral reef resources	1, 2, 3	Division of Aquatic and Wildlife Resources	\$120,000	N	
Determine which functional groups are missing from reefs outside of preserves. (i.e. herbivores, detritivores, piscivores)	Conduct monitoring of areas outside of the preserves.	1, 2, 3	Division of Aquatic Resources and Wildlife, University of Guam Marine Laboratory	\$80,000	N	
Hire a natural resources prosecutor based in Attorney General's Office to work exclusively on natural resource issues	Increase enforcement of environmental regulation	1, 2	Bureau of Statistics and Plans	\$180,000	year 1 funded	2004 NOAA/DOI Coral Management Grant
Guam Coastal Monitoring Assessment Program (EMAP)	Conduct and assess coastal water quality issues	1, 2, 3	Guam Environmental Protection Agency	\$800,000	year 1 funded	United States Environmental Protection Agency
Investigate whether this community shift has been caused by fishing or other impacts		1	Guam Environmental Protection Agency, Division of Aquatic and Wildlife Resources, Water and Environmental Research Institute, or contractor		N	
Identify fishing methods that demonstrate a disparate effect on reef fish communities and examine alternatives or regulations that could ease the impact on reefs.	Study based on crest survey results to help monitor reefs	1	Division of Aquatic and Wildlife Resources, University of Guam Marine Laboratory		N	
Provide educational material reminding fishermen that frozen fish lay no eggs and to catch only what is needed.	Educate community on fisheries issues	1	Division of Aquatic and Wildlife Resources or Contractor	\$30,000	N	



Guam Coral Reef Local Action Strategies Recreational Use and Misuse



Background and Rationale

In August 2002, the Guam Coral Reef Initiative Coordinating Committee (GCRICC) began to identify the main threats to local coral reefs as part of a process to prioritize funding and management efforts for the next three years. By February 2003, GCRICC identified local navigators and drafted Local Action Strategies (LAS) for four of the five chosen focus areas. The LAS process significantly expanded and enhanced the network of stakeholder groups working on coral reef issues.

Goals and Objectives of the Current LAS

Guam's Recreational Use and Misuse LAS working group outlined two main goals: 1) Identify marine recreational activities that adversely affect the environment; 2) Develop strategies with stakeholders to reduce or eliminate adverse effects to coastal habitats. Two anticipated outcomes were listed: one, reduction of damage by marine recreational activities and two, improved marine experiences for local residents and visitors. These goals and objectives were further refined in the Guam Coral Reef Management Priorities document for 2010-2015 which shows how Guam's priority goals and objectives correlate to the NOAA Coral Reef Conservation Program (CRCP) National Goals and Objectives for coral reef conservation including guiding funding allocations for management activities.

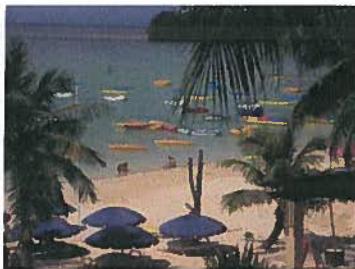
Goal: Improve the condition of Guam's coral reef ecosystems by reducing negative recreational impacts.

Objectives:

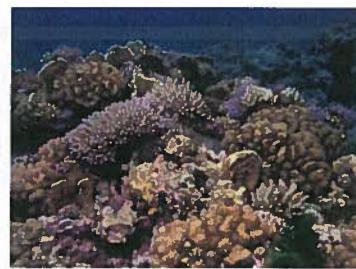
1. Adopt, implement and enforce existing recreational plans and programs including the Seashore Reserve, Recreational Water Use Management Plan, CAPs and the Marine Preserve Eco-Permit and enact new regulations for recreational use by 2015.
2. Expand education efforts tailored to specific resource user groups, including unlicensed dive operators (certification course, yearly report out).
3. Build partnerships with GVB, Guam Hotel and Restaurant Association, the Tourism Education Council, marine-based tour operators and Chamber of Commerce to educate visitors and residents about how to reduce recreational threats to coral reefs.
4. Examine sustainable finance mechanism to support the management and protection of resources. Examples include visitor fees, endowments, in-lieu fees, etc.

Proactive, practical and targeted management is urgently needed. The following actions were implemented to address the objectives listed in Guam's Coral Reef Priority Document:

- a) Evaluate direct, cumulative and secondary impacts of jet skis on coral reefs.
- b) Geographic Information Systems (GIS) layers for SCUBA, snorkeling, reef walking, surfing, etc.



Guam Coral Reef Local Action Strategies Recreational Use and Misuse



- c) Analyze impacts of recreational diving and develop strategies to reduce pressures.
- d) Air time for Public Service Announcements (PSAs)
- e) Printing of targeted material to educate visitors about coral reef conservation.
- f) Videos and printer material in various languages to be used at public outreach and education events.
- g) University of Guam (UOG) interns to provide beachside education about coral reefs to visitors and residents.
- h) Develop training program for tour guides and marine tour operators to reduce coral reef damage associated with recreational users.
- i) Remove unpermitted mooring buoys; replace buoys and install additional Shallow Water Moorings (SWMs) as needed. Conduct educational workshops to promote use.

Assessed gaps in LAS & recommendations for the next LAS

The importance of the role of the Department of Parks and Recreation must not be underplayed when managing marine resources. Proposed regulations rely on the capability of the lead agency being able to follow through with requirements.

While most dive shop operators understand and actively support minimizing the impacts of snorkeling, diving, anchoring and other marine activities, some small recreational operations are less familiar with the goals of marine preserve management and how easily corals can be damaged. In response to this lack of awareness, the development of training programs for tour guides and marine tour operators comes highly recommended. Best management practices must be implemented to protect the health of our marine resources. As many of these activities occur within public parks, the Department of Parks and Recreation must play an active role in management.

The Recreational Water Use Management Plan (RWUMP) was developed in response to growing concerns about the interference on traditional fishing activities by mechanized water recreational craft (MWRC). The RWUMP is meant to provide stakeholders with a comprehensive tool to identify the rules and regulations that are used to manage their activities, ensure their safety, and prevent conflicts among user groups. The RWUMP can be improved upon to accommodate the increase of interest in marine recreation in an efficient and transparent manner (RWUMP, 2010).

In addition to education being readily available for all resource users, communications with the Port and potentially Power Authorities are necessary to reduce traffic in other areas (i.e. Piti Bomb Holes and Tumon Bay Marine Preserves, etc). Additional user concerns include but are not limited to: concerns regarding litter and crimes (theft and vandalism); safety; operators functioning without proper permits competing with permitted operations; and lack of law enforcement.

A study review of recreational-based activities that provides information of assessing best management practice guidelines for recreational activities would be beneficial (i.e. strategy sessions, a feasibility study for mooring buoy usage, sustainable funding sources [targeted recreational campaign], evaluating effectiveness of existing mascots/campaigns).

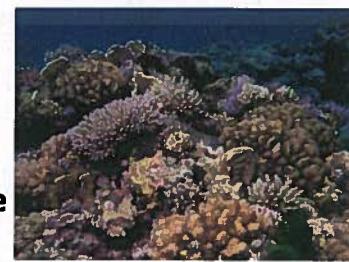
Table 1. Five-year Local Action Strategy Document, 2010-2015**Focus Area: LAS Recreational Use & Misuse****Goal: Improve the condition of Guam's coral reef ecosystems by reducing negative recreational impacts.**

GRANT	TITLE	DESCRIPTION	PI	AGENCY	AMOUNT	STATUS
CRI05	Effects of motorized personal watercraft on Guam coral reef ecosystems	Evaluate direct, cumulative and secondary impacts of jet skis on coral reefs.	Trina Leberer	DAWR	45000	Completed.
CRI06	Development of GIS map layers for areas of water recreation activities and related water recreational business activities	GIS layers for SCUBA, snorkeling, reef walking, surfing, etc	Victor Torres	GCMP	25000	Completed Summary Recreational (RUMP) document but no GIS layers.
CRI06	Basic SCUBA instruction sites study	Analyze impacts of recreational diving and develop strategies to reduce pressures.	Victor Torres	GCMP	15000	Completed. Document available at BSP-GCMP. Document needs to be loaded onto website.
CRI09	Generate public service announcements for a variety of recreational issues	Air time for PSAs	Evangeline Lujan	GCMP	10000	Completed.
CRI09	Print informational brochures about coral reefs in hotel lobbies and hotel rooms	Printing of targeted material to educate visitors about coral reef conservation. (Fish cards)	Evangeline Lujan	GCMP	7000	Completed.
CRI10	Multi-language documentaries about Guam coral reefs	Videos and printer material in various languages to be used at public outreach and education events.	Evangeline Lujan	GCMP	19611	Completed and available on Reef Vision: http://reefvisionproject.blogspot.com/
NA10NOS4190115	Recreational Users Video	Videos for recreational users: The do's and don'ts of appropriate marine recreational activities.	Evangeline Lujan	GCMP	60000	Ongoing.
CRI14	Tasi Beach Guides	UOG interns to provide beachside education about coral reefs to visitors and residents.	Elvie Tyler	UOG	42450	Ready to implement/train docents.
CRI14	Recreational user certification	Develop training program for tour guides and marine tour operators to reduce coral reef damage associated with recreational users.	Evangeline Lujan	GCMP	50000	Incorporate into existing GVB course.
CRI15	Installation of mooring buoys for recreational users	Remove unpermitted mooring buoys; replace buoys and install additional swms as needed. Conduct educational workshops to promote use.	Jay Gutierrez	DAWR	60000	Feasibility study might be good.

* PI's as originally written into the Grant.



Guam Coral Reef Local Action Strategies Climate Change and Reef Resilience



Background and Rationale

In August 2002, the Guam Coral Reef Initiative Coordinating Committee (GCRICC) began to identify the main threats to coral reefs to prioritize funding and management efforts for the next three years. By February 2003, GCRICC identified local navigators and drafted Local Action Strategies (LAS) for four of the five chosen focus areas. The LAS process significantly expanded and enhanced the network of stakeholder groups working on coral reef issues.

Climate Change and Coral Disease was selected as one LAS due to the increase in coral bleaching and disease outbreaks observed in the Pacific in the 1990s. In 2008, the working group for this LAS updated the scope and changed the title to Climate Change and Reef Resilience to reflect the need to improve the resilience of Guam's coral reefs in the face of major impacts such as Global Climate Change and the Military Buildup. This LAS focuses on the need for proactive, practical and targeted management efforts to improve the resilience of Guam's reefs and human communities.

Goals and Objectives of the Current LAS

This LAS is designed to address 4 key areas: a) climate change, specifically the impacts of ocean acidification and sea surface temperature warming; b) coral disease; c) nuisance and invasive species; and d) the resilience of Guam's human communities affected by coral reef loss and degradation. We recognize that synergisms between these issues are of major importance and that flexibility be built into proposed management plans.

GOAL: Improve management of Guam's coral reef ecosystems to enhance resilience and recovery processes.

Objectives:

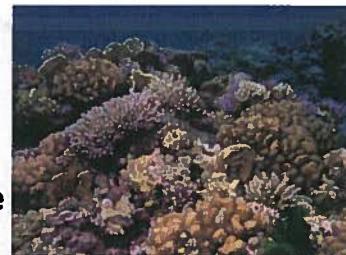
1. Establish and prepare response teams to address bleaching events, disease and predator outbreaks and other acute events (e.g., ship groundings, chemical spills).
2. Address the issue of human community resilience to climate change, in the presence of coral reef loss and degradation. (Resilient communities are capable of bouncing back from adverse situations. They can do this by actively influencing and preparing for economic, social and environmental change.)
3. Investigate connectivity at site specific, local, archipelagic, and regional scales for multiple taxa (corals, fish, other inverts, algae) and develop management strategies to increase reef resiliency.
4. Increase understanding of the causes of coral bleaching and disease associated mortality on Guam and investigate approaches to stimulate recovery and rehabilitation.
5. Quantify the extent of nuisance and invasive species affecting Guam's reefs and investigate and test management approaches.
6. Establish current baselines and investigate consequences of climate change, such as ocean acidification and sea level rise in coral reef ecosystems of the Western Pacific.

The following projects have been conducted or are ongoing:

- Develop connectivity models at site-specific, local, archipelagic and regional scales based on data obtained through targeted research activities



Guam Coral Reef Local Action Strategies Climate Change and Reef Resilience



- Increase understanding of the causes, spread and impacts of the known diseases affecting Guam's reefs and identify environmental drivers of bleaching and disease in Guam.
- Research on *Acanthaster planci* including island wide monitoring and development of attractants and potential control measures.
- Monitor and remove *Acanthaster* from priority reef sites during outbreaks.
- Survey sensitive areas and develop a monitoring protocol to use a subset of these areas as an early warning of habitat impacts.
- Engage stakeholder community in monitoring and reporting of impacts to reefs.
- Develop and test approaches for rehabilitation
- Develop response plans for bleaching events, disease and predator outbreaks, and other acute events (e.g., ship groundings, chemical/oil spills) and develop toolkits for response.
- Develop regulations to improve responses to anthropogenic acute events (e.g., ship groundings, chemical/oil spills), including natural resource damage assessment, fines and compensatory mitigation.
- Training to improve response-team skills. Past trainings have included Natural Resource Damage Assessment and Coral Reef Crime Scene Investigation.
- Develop and test approaches for mitigation and rehabilitation after impacts.

Assessed gaps and recommendations for next LAS

This LAS remains highly relevant and does not require major revisions. However, there is a need to support key activities to improve the resilience of Guam's reefs and prepare our community for potential impacts of climate change and ocean acidification.

Reef monitoring programs should continue to receive support. The collection of high quality data will document changes in Guam's reefs, help managers make decisions, and assess the success of management activities.

An evaluation of social, economic and political impacts of reef events such as bleaching and disease outbreaks is needed to better inform management plans. Community adaptation strategies developed in other jurisdictions may also be helpful in designing effective management efforts.

Response and restoration / rehabilitation is another area that needs more attention. Managers need tools and resources to respond to events such as groundings and spills. Legislation to establish fines for reef impacts and facilitate emergency procurement would support these activities.

A number of non-native species have been identified in Apra Harbor and more may be arriving, yet Guam has not addressed marine biosecurity. It is important to establish baseline information and begin developing strategies to address the potential for marine invasive species impacts.

While data collection and modeling of ocean currents and connectivity has begun, there are still numerous gaps that need attention. This information will be crucial to identify sources and sinks for key species of various taxa and allow managers to refine reef management strategies to maximize resilience (e.g., MPA siting, prioritization of land-based management activities, etc.).

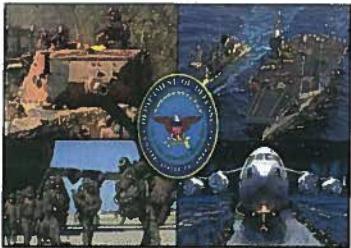
Table 1. Five-year Local Action Strategy Planning Document, 2010-2015
Focus Area: Climate Change and Reef Resilience

GOAL: Improve management of Guam's coral reef ecosystems to enhance resilience and recovery processes.

Grant Title	Description	PI	Agency	Amount	Status
CRI06 Development of coral disease/ bleaching impacts working group for Guam	Initial steps of disease/ bleaching focus group efforts - core members from UOG ML, DAWR, NPS, GEPD to document, monitor and research impacts - disease, predation, pest species, bleaching	Laurie Raymundo and Peter Schupp	UOG ML	15000	Completed.
CRI06 Complete an island-wide baseline survey of Guam's reefs to quantify disease, bleaching, coral predators and invasive species (i.e. <i>Terpios</i> sp. sponge) impacts	Surveying Guam's reefs for total disease prevalence and severity, specific disease present, host species affected, density and abundance of major coral predators (i.e. Crown of Thorns starfish, and the molluscs Drupella and Corallophyllia), host preferences of these predators, species (if any) exhibiting bleaching, bleaching severity and extent, location and severity of invasion by the coral-killing sponge <i>Terpios</i>	Laurie Raymundo	UOG ML	26,600	Completed.
CRI09 Support for rapid response team to investigate groundings, bleaching events, disease outbreaks	Facilitate organized, rapid response to events. Establish response team, formalize guidance on restoration and mitigation, training on response protocols.	Jay Gutierrez/ Jesse Cruz	DAWR/ GEPA	58200	Completed. Obtained supplies and materials for response. Conducted training
CRI10 Management of Acanthaster planci outbreak	Survey of COTs to track populations, impact sites; removal using traditional and innovative techniques. Outreach and awareness campaign, including outbreak reporting network via email and phone.	Peter Schupp (Ciemon Caballes)	UOG	39914	Completed. Resulted in UOGML thesis C. Caballes.
CRI11 Investigating unusually high coral reef mortality within Piti Marine Reserve	Establish spatial extent of significant disease impact; quantity and characterize sewage nutrient load, bacterial load and temp; establish patterns of reef use by tourist community; examine recruitment rates on dead microatolls and recovery of previously disease colonies. [white syndrome on <i>Porites cylindrica</i>]	Laurie Raymundo	UOG	52019	Completed. Awaiting final report.
CRI12 Coral health impacts workshop	Focus on field techniques directly applicable to managers. Five-day workshop including assessment and monitoring strategies, data management, mgmt responses to outbreaks of disease or predators and bleaching events	Laurie Raymundo	UOG	30000	Completed. Workshop held in January 2013.
CRI14 Addressing the loss of a key functional group - Staghorn Acropora - on Guam reefs	Establish reproductive timing, collect tissue samples for genomic archive, begin pilot projects for culture and outplanting	Laurie Raymundo	UOG ML	52610	Future
CRI14 Reef resilience coordinator	Coordinate efforts to integrate reef resilience principles into management and education efforts			50000	Future

CRI15	Addressing the loss of a key functional group - Staghorn Acropora - on Guam reefs	Establish reproductive timing, collect tissue samples for genomic archive, begin pilot projects for culture and outplanting	Laurie Raymundo	UOG ML	52610	Future
CRI15	Reef resilience coordinator	Coordinate efforts to integrate reef resilience principles into management and education efforts	Evangeline Lujan	GCMF	50000	Future

* PI's as originally written into the Grants.



**Guam Coral Reef
Local Action Strategies
Department of Defense (DoD)
Expansion and Related Impacts**



Background and Rationale

In August 2002, the Guam Coral Reef Initiative Coordinating Committee (GCRICC) began to identify the main threats to local coral reefs as part of a process to prioritize funding and management efforts for the next three years. By February 2003, GCRICC identified local navigators and drafted Local Action Strategies (LAS) for four of the five chosen focus areas. The LAS process significantly expanded and enhanced the network of stakeholder groups working on coral reef issues.

Goals and Objectives of the Current LAS

Guam's Department of Defense (DoD) Expansion and Related Impacts LAS working group outlined three main goals: 1) Reduce sediment in three of Guam's watersheds; 2) Manage the impacts of non-point source pollution through Guam Nonpoint Pollution Control Program; and 3) Govern activities directly impacting waters through federally authorized Water Quality Certification Program. These were further refined in the Guam Coral Reef Management Priorities document for 2010-2015, which shows how Guam's priority goals and objectives correlate to the NOAA Coral Reef Conservation Program (CRCP) National Goals and Objectives for coral reef conservation including guiding funding allocations for management activities.

Goal: Mitigate the existing and anticipated pressures of rapid development on Guam's coral reefs by implementing the Guam Natural Resources Strategy with a focus on Apra Harbor through 2012.

Objectives:

1. Adopt and implement Compensatory Mitigation Policy by summer 2010. The policy shall address all aspects of an effective multi-agency approach to mitigation and will be compatible with existing federal policies while addressing Guam's unique resource-management challenges.
2. Develop and implement comprehensive monitoring of water quality and coral reef ecosystem parameters within watersheds targeted for watershed restoration, with a focus on evaluating the effectiveness of watershed restoration efforts implemented as compensatory mitigation for impacts to coral reef resources.
3. Implement the goals and conservation actions listed in Chapters 6-17 of the Guam Natural Resources Strategy.

****Refer to the Guam Buildup Natural Resources Strategy 2012.**

